The Antarctic Sun

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January 30, 2005

Photo by Byron Adams / Special to *The Antarctic Sun*

Researcher Jeb Barrett takes soil measurements at Cape Hallett as a curious Adélie penguin watches.

Seeking answers in dirt and snow

Scientists compare Cape Hallett soil life and climate to Dry Valleys

By Emily Stone
Sun staff

Scientists are looking to a tiny spit of land on the Ross Sea coast for answers about why biodiversity varies across the Earth, as well as for a record of past and possible future climate change in Antarctica.

Cape Hallett juts into the Ross Sea about 600km north of McMurdo Station. The scientists working there are part of the Long Term Ecological Research (LTER) project in the Dry Valleys, and are conducting a related, yet separate project at Cape Hallett. The project there has two components, a soil biodiversity study and a climate study.

The soil biodiversity work is being coordinated with New Zealand's Latitudinal Gradient Project. That project looks at how biodiversity varies from north to south along the edge of the Ross Sea.

See Hallett on page 8

Mars' mysteries unraveled in Beacon Valley

Conflicting theories give different dates for age of ancient ice buried under polygon-shaped cracks

By Kristan Hutchison
Sun staff

Forget the heavens. After years studying other planets, Jim Head found Mars on Earth.

It comes with ice 7 million years old, buried under a paralyzed landscape in the Beacon Valley that has been unchanged since before humans evolved.

"It was an epiphany for me," said Head, who first saw photos of Beacon Valley when he invited geologist Dave Marchant to give a seminar at Brown University. "I looked at it and said 'I've seen that on Mars.'"

Since then, Marchant, who teaches at Boston University, and Head have been collaborating to understand the processes creating the extremely stable landscape in parts of the McMurdo Dry Valleys, which can then be applied to understanding the landscape of Mars.

"It's not one of those things where you have to take the process here and twist it and contort it and force it to fit," Marchant said. "We simply take the processes here and our understanding of how glaciers form and apply them almost seamlessly to Mars. It's a little bit scary how well these things fit."

Down in the valley

To an untrained eye, Beacon Valley is just a field of brown stones.

But when seen from above, a pattern emerges. A web of cracks runs through the field, breaking it into polygon shapes. From even higher up, the brown valley floor forms concentric curves as if the rocks were carried on a thick pudding oozing slowly forward.

Essentially, that is what Marchant believes has happened in the Beacon Valley. The rock layer hides an ancient glacier. It is

See Old ice on page 9

INSIDE

Quote of the Week

"I say we require all world leaders to get their clothing from the CDC. Everybody looks happy and content in Big Red."

- Woman talking about the vice president's Antarctic-like outfit at a ceremony at Auschwitz

Ross Island Chronicles By Chico

Cold, hard facts

Random Antarctica

Snowcones per person in the world to use up iceberg B-15: 2 million

Years of higher education among McMurdo's 28 dining attendants: 121

McMurdo dining attendants with master's degrees: 5

Movies shown each week on McMurdo TV: about 70

Pounds of meat served last week in McMurdo dining hall: 2,235 beef, 486 chicken, 764 fish, 260 of pork

Meals served at South Pole last week: 5,016

Place in Japanese box-office history of the 1958 movie "Antarctica": 2nd

Sources: Karen Joyce, Tami Carsillo, Brian Spiegel, Eric Sturm, Katelyn Bendzell, Yahoo Movies, South Pole Situation Report

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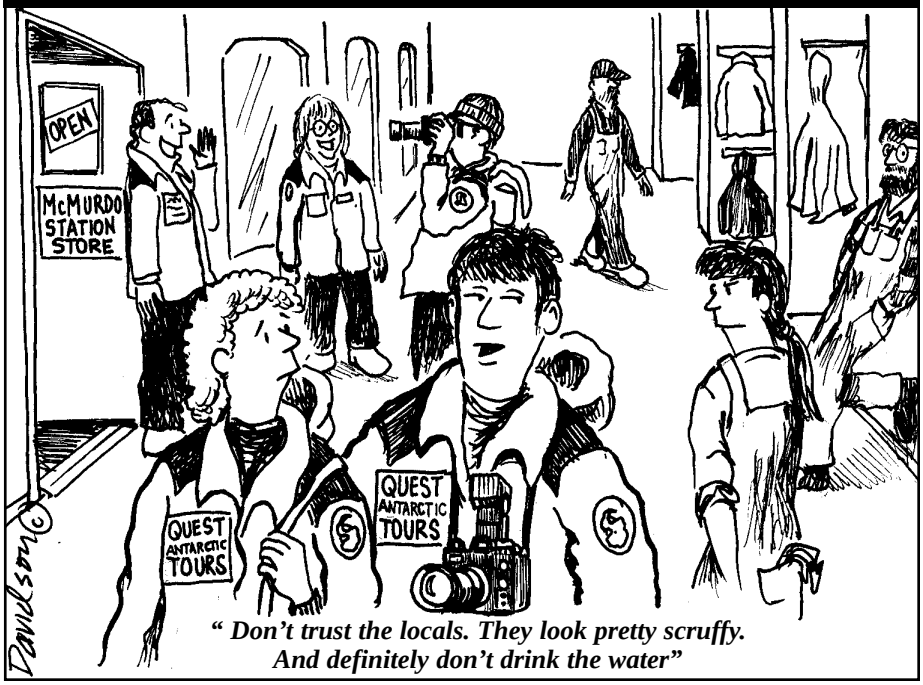
Web address: www.polar.org/antsun

It's a Harsh Cartoon **Matt Davidson**



" Don't trust the locals. They look pretty scruffy. And definitely don't drink the water"

Photo from the NSF photo library


Photo from the NSF photo library


Photo by Emily Stone / *The Antarctic Sun*

Left, the ground crew prepares a C-141 on the ice runway near McMurdo Station. The C-141s are being replaced by C-17s, like the one at top right. Bottom right, a ski-equipped LC-130 prepares to take off at the South Pole skiway to fly back to McMurdo Station.

So long, C141, and thanks for all the flights

By Emily Stone
Sun staff

Antarctic workers on the long flight between New Zealand and McMurdo Station will no longer have the pleasure of sitting smashed up against their seat mates, stepping over 30 people to get to the bathroom or carefully putting their stockinged feet between the people across from them to stretch out.

The U.S. Air Force is retiring the aging C-141 airplanes that have transported U.S. Antarctic Program employees those 3,800km since 1966. The last C-141 flight is Feb. 4. After that, all flights will be on C-17s, which are roomier, more comfortable and more fuel-efficient.

"It's time to put them in the bone yard," said Col. Tye Beasley, commander of Support Forces Antarctica. The planes' final resting place will be at Davis-Monthan Air Force Base in Tuscon, Arizona.

The C-17s started being used for Antarctic flights in 2002. The plane was built by the Air Force to replace the C-141s. A C-17 can carry more than twice as much weight as its older counterpart.

"The C-141 has really been the strategic airlift workhorse for Operation Deep Freeze for years," Beasley said. "While it has definitely done a huge part of the mission, the C-17 is a more comfortable airplane to fly on from a passenger standpoint. There's more cargo. It's more fuel-efficient. ... Everything's a little bit better in it."

Ray Gabriel, the U.S. Antarctic Program's transportation planner, said there will be discussions this summer about whether the switch to C-17s means the program will use fewer flights during the summer season. Because there still will be a need to move people between Christchurch and McMurdo several times a week, the number of flights a week may stay the same, he said.

The switch doesn't necessarily mean a comfortable ride for everyone. People going to the South Pole will continue to ride on the even more cramped LC-130 "Hercules" airplanes, which are the only planes that make the trip between McMurdo and the South Pole.

The C-141s were first built in 1964 and can carry about 20,400kg of cargo. Passengers onboard sit in four rows, arranged into two sets of two rows that face each other. People sit close enough so their knees are nearly touching, leaving no aisle. To move around the plane, passengers must carefully maneuver through the tangle of knees.

The C-17s were first built in 1993 and can carry about 45,400kg of cargo. Passengers sit in rows of seats facing forward, like on a commercial airplane, with two additional rows of seats facing the center along either side of the plane.

C-141s continue to be used by the Air Force in other parts of the world, such as for medical evacuations between Iraq and Germany, Beasley said. But it's time to retire them from Antarctic work.

"They're 40-plus years old," he said. "They've exceeded their lifetime expectancy."

Rocks *(answer on page 7)*

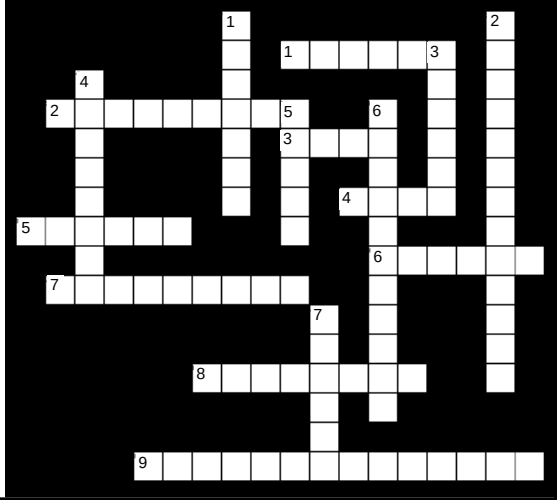
By John Deaton

Across

1. A volcanic rock found only on Mt. Erebus and on Mt. Kenya.
2. A smooth, wind-eroded rock that typically has three sides.
3. A system of fractures in the Earth's crust that develop when the crust thins and separates.
4. The supergroup forming the basement of the Transantarctic Mountains.
5. Mountain whose elevation is 16,066 feet above sea level.
6. The supergroup forming the western peaks of the Transantarctic Mountains.
7. The mountains overlooking the Ronne Ice Shelf.
8. The mineral that forms crystals in the neck of the Erebus volcano, ejected when it erupts.
9. Someone who studies fossils.

Down

1. Eskimo word for an isolated, spire-shaped peak protruding from the surface of the ice or snow.
2. Someone who studies volcanoes.
3. Mountain that supports the only thermophilic algae in Antarctica.
4. The range containing Antarctica's highest peak.
5. Fossils left in sediment by the activity of animals.
6. Intermittent eruptions for which Erebus is famous.
7. Dark, volcanic rock that Castle Rock is made of.



Part-time filmmakers show off talent

Compiled by Brenda Everitt

People whose day jobs at Antarctica's research stations have nothing to do with the silver screen recently debuted their movies, made in their off hours using personal video cameras and laptops.

"Spectacular!" "Way cool!" "Better than the holidays!" and "The best night of the season" were some of the comments heard around South Pole Station after the standing-room-only screenings of the South Pole International Film Festival / SPIFF 2005, which played to wildly enthusiastic and appreciative crowds. The event was hosted by "Cookie" Jon Emanuel, who introduced each film. Polie filmmakers squeezed in time all season to prepare 18 movies.

The world-premiere screening began with an introductory film by Tyler Regan that featured short takes of Polies in various station settings — with some in their traditional national attire — welcoming viewers to the international event in multiple languages.

Other films included:

"A Trip to the South Pole," by Pain Cave Productions (Nathan Bahls, Philip Clark, Dan Simon, and Travis Wheeler) was a black-and-white, 1950s-newsreel-style film that gave a tongue-in-cheek 'introduction' to living and working at the South Pole.

Joe Bayley (J. Paul Bayley Productions / Pocahontas Food Service Films) produced two films for the festival. The first, "Beyond Polar Dome," was a "Mad Max"-inspired parody, featured a mano a mano battle between two men staged in the station's radome. The second production, "Night Owls," employed a supposedly "hidden" camera that revealed chefs being "caught in the act" of adding secret ingredients to the food, which elicited nervous laughter from the audience.

Tyler Regan (Out of Range Entertainment/Ninety Below Filmworks) made many other films in addition to the introductory film. "Descent" is a meditative work starring Liesl Schernthanner as a woman ice-climbing her way to the bottom of the world. Regan's other films included, 'Man in the Box,' starring Jed Miller; "Dan Lindberg Eats Froot Loops," a 37-second gastronomic extravaganza; a music video titled "By the Great and Mighty" by the Polie band "Fingie Lickin' Good" performing Queen's "Tie Your Mother Down;" and a 10-minute concert film of "Squeaky Meat" performing "Sometimes Life is Black and White" — also the title of the film.

The opening to the film "A Trip to the South Pole," by Pain Cave Productions (Nathan Bahls, Philip Clark, Dan Simon, and Travis Wheeler).

Coming to a theater near you?
Probably not, since most of the films are not available off the continent. However, Filmmakers are invited to have the movies or links to movies on their sites posted at www.antarcticfilmfestival.com.

Forest Banks (Nacreous Productions) produced the serious drama "Top of the World" featuring an excellent performance by David Pernic as a man who faces deep emotions and takes drastic action. Banks' second production, titled "Dalrymple" is a documentary featuring the now 81-year-old Paul Dalrymple recalling his experiences while living and working at Pole in 1957-1958 and showed footage of Old Pole.

Alison Van Dusen, a general assistant on station, made her first film, a music video called, "One."

"Since high school dance class I have always wanted to choreograph a piece to 'One' by Three Dog Night," she said.

Darryn Schneider, a scientist with the IceCube science project, created "Antarctic Odyssey," featuring fascinating time-lapse photography of the large science project as it was assembled.

Attila Agoston's "What do you do when you're not at the South Pole?" starred a wide variety of Polies answering the self-titled question.

Tom Piwowarski ("Pi") produced a hilarious mockumentary titled "Osama Bin There, Done That" in which an unexpected visitor from the Middle East may have stowed away in a tri-wall box to reach and roam around South Pole Station undetected.

The movie "Bugus Antarcticus" was another mockumentary, produced by Melany Zimmerman and Eric M. Brown. The film featured the discovery of animal and plant life in Antarctic crevasses that live off neutrinos.

Another submission solved the long-standing station mystery of who stole the small furry kitten mannequin from the cargo office. The film showed the missing kitty being saved by "Mr T," played with great bravado by Floyd Washington. Although the captors' faces were not revealed, and it was submitted by "Anonymous," the drama clearly took place in the carpenter's shop.

The evening's grand finale was an epic action/adventure movie produced and directed by veteran South Pole filmmaker Joe Speidel. "Pulaski" featured Brooke Berens' outstanding performance as a hero vastly outnumbered in a big rumble in the new station to save her little sister from weapon-wielding thugs. As the thugs threatened to advance toward the hero, they noticed a posted sign, and paused to put on their required eye protection, much to the delight of the audience.

McMurdo gets in on the act with 11 movies entered in station's first festival

Sun staff

South Pole wasn't alone in featuring world premieres. McMurdo Station hosted the first of what many there hope will be an annual film festival. Eleven short movies by 10 directors, featuring dozens of actors from around the station, debuted to a packed dining hall. Nearly half the entries in this year's festival used time-lapse video. The film festival generated a lot of buzz, repeat showings and high hopes for a follow up next year. Here are this year's movies, director and a short description of each:

"Beautiful Day," Joe Harrigan: A time-lapse showcase of the McMurdo area.

"Citizen Frenchie," J.P. Murad: One man's quest for sleep amid paranoia.

"The Cold Part," Atilla Agoston: An avant-garde view of the gritty side of Antarctica.

"A Day Spent Copying The Antarctic Sun," Brien Barnett: Time-lapse of the frustrations with an old copier.

"McMurdo Loads," Steve Alexander: A time-lapse of the annual resupply ship offload and onload process.

"One Night on a Stand," Craige Mazur: Time-lapse videography of sea ice, Mount Discovery and clouds.

"Penguins," Marianne Okal: A well-composed video from above and below the surface at Penguin Ranch on the sea ice.

"Southern Exposed," Eric/Tanya Sturm: A parody ad featuring the infamous bar.

"Stuff," George Nuckols: Scenes from around Antarctica.

"Time to Spare," Brien Barnett with Sandwich: The life of a pinsetter at McMurdo's bowling alley.

"Waiting for Burt Bacharach," Craige Mazur: A comical take on what it's like to live and work at the Odell Glacier runway.

around the continent

SOUTH POLE

Getting ready for winter

Compiled from reports by Brenda Everitt and other sources

The last piece of steel for the new station has been flown to the South Pole and panels on the B4 wing have been put in place. Construction and science projects continue to gear up for the winter season ahead.

The Sunday science lecture titled "Cosmology from the Polarization of the Cosmic Microwave Background Radiation" was presented by Sarah Church from Stanford University on Jan. 22. Church discussed a new experiment that is being installed this year to map out the polarization patterns present in the Cosmic Microwave Background (CMB) radiation, the faint relic of the Big Bang.

These signals, along with measurements of the temperature variations of the CMB, help scientists do so-called "precision cosmology," which allows modeling the origin of all structures in the universe, to predict their fate, and perhaps better understand gravity in the extreme environment that characterized the beginning of time.

In addition to the annual South Pole International Film Festival *(see story on Page 4)*, several other activities occurred on station over the weekend. Two tournaments were held simultaneously; a cribbage tournament in the dining hall and a table tennis tournament in the basketball gym under the dome. The table tennis tournament winner was Al Baker, who also took the top place in last year's tournament. The top winner in cribbage was James Sciarrino.

PALMER

Adelie census underway

By Kerry Kells
Palmer correspondent

January is a busy month for Palmer Station with science in the full swing of summer and the arrival of cruise ships and sailing yachts making our harbor and inlet popular sites. The weather has been mild, with light winds and some brash ice. The month started off with the arrival of the *Endeavour*, the first cruise ship of the new year. The *Sarah W. Vorwerk* was the first sailing yacht to arrive at station, followed by the *Vaïheré*. Both will return to station later in the summer. Soon after, the *Zazie*, a smaller yacht about 10m in length, arrived with a family of four from New Caledonia. They had been sailing the Pacific waters for two years. Three cruise ships arrived the second week of the month: the *Amsterdam*, the *Bremen* and the *Orion*. And this week, we welcome back the *Endeavour* cruise ship which will bring two special visitors to station: Palmer Area Director Bob Farrell's mother and stepfather.

The *Laurence M. Gould* continues to sample along the Long Term Ecological Research grid and reached Rothera Station. They report that the seabird researchers landed at Avian Island. The researchers will census the island and compare it to a census of 1982. The Adélie population is believed to be 30,000 to 45,000 breeding pairs. We were given a presentation of seabird research at Palmer Station at the Wednesday night science lecture. Heidi Geisz, who has four seasons with Bill Fraser's seabird research team, presented information on seabirds with emphasis on Adélie penguins. She works with Bill Fraser's group researching global climate change and Adélie populations for long term research, as well as gentoo and chinstrap penguins, giant petrels, brown skuas, South Polar skuas and cormorants.

Geisz spoke about past and present research on Adélie penguins in the area. There are 2.5 million breeding pairs of Adélies in Antarctica. Unlike other birds, penguins have solid bones. They can dive for 7 minutes to depths of 170m. Adélies lay two eggs and a couple share the raising of chicks. The male sits on the egg for the first 10 days while the female leaves to feed. Then she returns and sits on the egg and they will switch about every three days. When the chick hatches, the parents trade duties every day. The chicks will fledge together in large groups as a protective measure against predators, including leopard seals and brown skuas. Of those that fledge, only 8 percent to 12 percent will survive the first winter.

Geisz also spoke briefly about the Southern Ocean Global Ocean Ecosystem Dynamics (SO GLOBEC) cruise from the winter of 2001. The research focused on population variability in response to environmental change and scientists sampled

See Continent on page 6

Photo by Cara Sucher / The Antarctic Sun

Heidi Geisz watches Adélie penguins on Torgersen Island in the Antarctic Peninsula.

the week in weather

McMurdo Station
High: 36F / 2C
Low: 18F / -8C
Max. sustained wind: 22mph / 35kph
Windchill: -8F / -22C

Palmer Station
High: 44F / 7C
Low: 31F / -1C
Max. sustained wind: 18mph / 28kph
Precipitation: 8mm

South Pole Station
High: -27F / -17C
Low: -35F / -31C
Peak wind: 14mph / 23kph
Max. Physio-altitude: 3,192m

Continent From page 5

along the same grid pattern as the LTER. The penguins' diets were sampled. Transmitters were attached to their bodies to track them throughout the winter. The transmitters will fall off when the penguin molts. The majority of Adélies go south for the winter. With the transmitters, the scientists could track the winter foraging range, as well as the autumn and winter movements over a 110-day period. They tracked one juvenile who had traveled 3,440km. Other factors for breeding success include weather and snowfall. Adélie penguins lay their eggs within the same two-week window every year, a factor that has affected their population. With more snow in early summer, the nests are covered and the eggs can be frozen in ice and destroyed. In comparison, the gentoo penguin, whose populations have increased, have a more flexible breeding period and a longer egg-laying window. Data shows that the Palmer area's average annual temperature has increased 2.5C over the past 30 years.

Bill and Donna Fraser's Polar Oceans Research Group continues to be an important part of the LTER and at Palmer Station. Their research spans 30 years of studying global climate change and seabirds in the Palmer region. Geisz will return to Virginia Institute of Marine Science at The College of William and Mary to continue her graduate studies. Her thesis concentrates on persistent organic pollutants in seabird breeding on the Antarctic Peninsula. She will identify the presence or absence of brominate diphenyl ethers (a chemical found in plastics) in giant petrels and south polar skuas and monitor DDT levels in Adélie penguins.

SHIPS

Laurence M. Gould

Compiled from reports by Andrew Nunn
Jan. 16 to 24

After deploying the sediment trap, the *Laurence M. Gould* returned to Palmer Station to pick up a Zodiac outfitted with a trawling platform for use at one of the Long Term Ecological Research sampling stations. The ship followed the grid of sampling stations for several more days while researchers collected water samples and data. A field team was dropped at Avian Island to work with the seabirds there.

"It was an excellent day for Zodiac ops with clear skies, sunshine, and calm seas. There was very little ice in the area around Avian," wrote marine projects coordinator Andrew Nunn.

The next morning the *Gould* arrived at Rothera, the British research station, to exchange science teams. The *Gould* crew welcomed 13 British scientists aboard for the day while 14 Americans went ashore. On board, the British and American teams did three joint samplings of the conductivity and temperature of the water at depth. In the afternoon the *Gould* returned to Rothera for a brief port call.

"I'm sorry to report we lost to the British 2-0 in the soccer game, even with the able assistance of our two Chilean deck hand "ringers," reported Nunn. After dinner the Rothera band set up in the sled shop for an evening of music and dancing.

The *Gould* departed Rothera in the morning and returned to the sampling stations in Margarite Bay. Though there was some cloud cover, the seas and winds remained calm as the researchers returned to their routine of sampling.

It was an unusual sight as four ships parked near McMurdo Station Jan. 26. The closest ship on the right, is the fuel tanker the USN Paul Buck. *On the left is the icebreaker* USCGC Polar Star. *Parked out in the sea ice, center, is the Russian icebreaker the* Krasin. *The ship in the distance on the far left is the research vessel the* Nathaniel B. Palmer.

Photo by Brien Barnett / The Antarctic Sun

Nathaniel B. Palmer

Compiled from reports by Alice Doyle
Jan. 19 to 21

After a couple days of intensive water sampling, the *Nathaniel B. Palmer* was able to transit the channel opened by the *USCG Polar Star* and arrived at McMurdo Station Wednesday to swap science groups.

The weather remained beautiful for the sampling, with blue skies and little wind. They even had a very curious and somewhat aggressive Weddell seal around the ship.

"He first almost tried to board the Zodiac and when that did not work, he tried to board the ship," wrote marine projects coordinator Alice Doyle.

The *NBP* transferred gear for two science projects aboard the vessel. The IVARS and ANSLOPE researchers were expected to board the ship this weekend to begin their nearly three-week science cruise to Hobart, Tasmania.

USCGC Polar Star

Compiled by Lt. Cmdr. Don Peltonen
Ship operations

Crews were busy with five vessels working in the vicinity of McMurdo last week including a visit by the Russian tour ship *Kapitan Khlebnikov*. The Russian icebreaker *Krasin*, under contract to the National Science Foundation, and U.S. Antarctic Program's research vessel *Nathaniel B. Palmer* escorted the military sea lift command fuel ship *Paul Buck* to within 12 miles of Hut Point. The *NBP* then fueled up from the *Buck* in the ice and proceeded to the ice pier for a brief port call. *Krasin* and the U.S. Coast Guard icebreaker *Polar Star* continued to groom the remaining 12 miles of the channel. Following the *NBP*'s departure Wednesday morning, *Krasin* and *Polar Star* escorted the *Buck* to the ice pier for mooring Wednesday afternoon. The *Buck* offloaded more than 22 million liters of fuel to McMurdo Station while also fueling *Polar Star* and the *Krasin*. The icebreakers will groom the channel for the *Buck*'s departure and the arrival of the annual chartered resupply ship *American Tern*. The *Tern* left Lyttleton, New Zealand, on Jan. 26 and is expected at the McMurdo ice pier by Feb. 3, when the vessel offload will begin.

LDB

CREAM flight ends

Sun staff

The record-setting CREAM, Cosmic Ray Energetics and Mass, experiment ended Jan. 28 when a charge separated the instrument from the balloon and a parachuted eased it to the ice below.

A team will be sent to recover the instrument. CREAM set the long duration balloon record at 41 days, 21 hours, 31 minutes and 30 seconds.

Photo by Opher Ganel / Special to The Antarctic Sun

CREAM descends.

Lakeside property: Nice neighborhood for microbes

Study looks at life in the wet zones

By Brien Barnett
Sun staff

When Michael Gooseff looks at lakes and streams in the Dry Valleys he sees hot spots in a cold desert.

This season, he and others are gathering data on the biological and hydrological processes that occur in the wet zones at the water's edge. Those zones stretch up to 10m from the water's edge. The question is whether the zones provide a distinct habitat, or hot spot, for microbes or whether the microbes simply thrive better in those zones than dry soil nearby.

According to Gooseff, an assistant professor at the Colorado School of Mines, moisture is drawn from lakes and streams and travels a short distance through the soil. It then evaporates, leaving behind salts and other chemical traces.

The processes that move the water through the soils are generally understood because similar systems exist worldwide. But because there is no rain and little groundwater, the delicate relationship of these margins to plants and microorganisms isn't. In other parts of the world, including places in Alaska that seem similar, there are too many outside factors for scientists to understand the basic systems. In streams, for example, falling leaves, animal feces and other factors can contribute to misinterpretations in data.

Photos by Brien Barnett / *The Antarctic Sun*

Graduate student Melissa Northcot unrolls temperature-sensitive wire on the floor of the hut at Lake Fryxell. The wire will be used to monitor soil temperatures over the next year in wet zones near the edge of the lake.

Photos by Brien Barnett / *The Antarctic Sun*

Michael Gooseff, of the Colorado School of Mines, checks a soil sample at a plot near the hut at Lake Fryxell in the Dry Valleys of Antarctica. Gooseff is studying wet zones near the lakes to determine water movement through the soils and its effect on microbial life.

> "It's better when it's wetter."
> — Michael Gooseff

At Lake Fryxell in the heart of the Taylor Valley and another 10 spots around the Dry Valleys, the soil communities are very simple. The movement of water and nutrients could be an important factor controlling the biology in these wet zones.

"These are simple systems," Gooseff said.

The scientists have selected a small plot of rocky shoreline to conduct their sampling and marked them with little blue flags. A small box with a single solar panel sits near the plot. A dozen or so brown wires lead into the box from locations from the water's edge to the top of the plots. The tips of the wires are buried in the ground, then run along the surface and into the box, which is recording the temperature of the soil at the various spots. The readings will continue through the Antarctic winter. Gooseff's team will return next year armed with more info from this year's samples and will retrieve the temperature data.

The group is studying lakes and several streams. The lakes have a fairly consistent boundary in the summer and change in the spring and fall as the ice thaws and refreezes. The streams can change quickly depending on the temperature and amount of meltwater flowing down the channel. The scientists want to know if those changes lead to changes in the microbial worlds that depend on that water.

Gooseff said the research his team and others conduct on these wet zones will result in a better overall understanding of the processes of these margins as well as the role water plays in dry, desert ecosystems.

"It's better when it's wetter," Gooseff said.

NSF-funded research in this story: Michael Gooseff, Colorado School of Mines

Answer to page 3 crossword

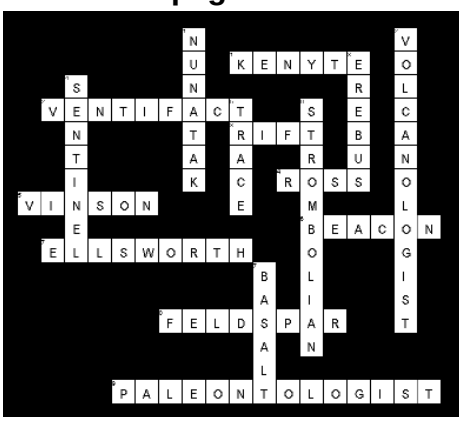


Photo by Byron Adams / Special to *The Antarctic Sun*

Cape Hallett, the bit of land in the foreground, as seen from a nearby hill. Scientists are studying biodiversity and climate changes there.

Hallett

From page 1

The Cape Hallett group will compare the organisms in the soil there to the organisms 620km away in the Taylor Valley, where much of the LTER work is done. Because Cape Hallett is slightly warmer and more nutrient-rich, it provides a useful comparison for work done in the Taylor Valley.

The goal is to get a sense of what changes biodiversity in one spot versus another. Is it strictly a warmer climate, or is it moisture, or chemicals and nutrients available in the soil? The advantage of doing the study in Antarctica is that it's home to some of the simplest, easiest-to-understand ecosystems.

"You can see all the players," said Byron Adams, of Brigham Young University.

The climate study is attempting to fill in the blanks in the climate history of Cape Hallett between the early 1970s and last year. A U.S. base at Cape Hallett collected meteorological data from 1957 through the early 1970s, when it closed.

The scientists in the study set up a new weather station there last year, which is collecting data. They also took a snow core from the area. They will calibrate the snow core information with the meteorological information to extrapolate back in time to determine what the average temperatures were and whether they've changed consistently since the 1950s.

Parts of Antarctica are getting warmer, though other areas appear to be cooling. The scientists want to know if Cape Hallett is warming, and if so, what can be learned from the changes. This information might help predict what would happen in colder parts of the continent if they warm significantly too.

Life in the soil

We all intuitively know that there's more diversity of life at the equator than at the poles. But little is known about why diversity varies within a region, said Diana Wall of Colorado State University. The Cape Hallett-Taylor Valley comparison should help explain that.

Both ecosystems are made up of soil microbes and invertebrates like nematodes, which are tiny worms; a microscopic animal called a water bear; and various microarthropods, such as mites. Both locations host fairly simple ecosystems. But the Cape Hallett soil is home to significantly more types of creatures and a greater number of each type than the Taylor Valley.

"It's just adding a little bit more people to the party," Adams said.

This is the second year the group has taken soil samples from the area. Last year they got a snapshot of the organisms, Adams said. This year's samples will be studied more rigorously.

The group will look at the diversity and try to understand how it is related to the difference in climate and environment at the two spots.

The goal is to take conclusions from these simple communities and use them to understand diversity on a global level, the scientists said. Why are there more species close to the equator? And what happens to diversity as temperatures rise and fall?

"It would be nice to somehow predict, oh, this is how these ecosystems are going to change as the climate changes," Adams said.

Climate history

Berry Lyons and Andrew Fountain are focusing on the question of climate change.

They want to piece together a full meteorological record at Cape Hallett from 1957 through the present day. Because of the gap in weather station data, they are trying to put the pieces together using a snow core.

They will calibrate the changes in the layers in the snow core with the weather station data. That way, they will understand what the changes in the snow core layers mean in terms of temperature. From there, they hope to determine what the temperature was during previous years by looking at the snow core layer from that point in time.

"It's not a standard technique, but it's the only technique we have available to fill in the gap," said Lyons of the Byrd Polar Research Center at Ohio State University.

"Has Cape Hallett warmed over the last 30 years? We'd like to know that," he said. "Everybody's interested in what's happened with climate on the continent."

The strict temperature measurements aren't the most exciting part of the study, Fountain said. Once the temperature analysis is done in four or five months, the climate scientists and the biodiversity scientists will consolidate their findings.

"The real payoff is when we take the climate data and use it to explain differences in soil biodiversity," said Fountain, of Portland State University.

The McMurdo Dry Valleys cooled some between the 1980s and 1990s, Lyons said, but overall they seem to have warmed over the last century. If the Dry Valleys continue to warm, then Cape Hallett may provide useful information for the scientists by serving as a model of a warmer ecosystem.

"The question is — and I don't know the answer — is it possible that Cape Hallett could be the future of the Dry Valleys," Fountain said.

Photo by Peter West / Special to *The Antarctic Sun*

A helicopter sits in the Beacon Valley. An ancient glacier lies beneath the rocks. One researcher believes the glacier is about 7 million years old.

Old ice

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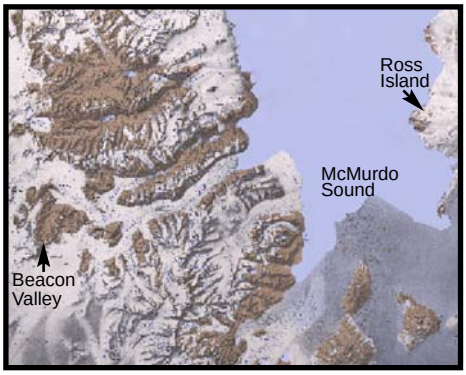
extremely slow, moving about 3cm a year near the origin of the glacier and less than 1mm near the end.

Marchant first found buried ice 15 years ago. He was in the Beacon Valley to study glacial deposits associated with early advances of the Taylor Glacier. As he walked through the valley behind another researcher, Marchant noticed something odd in the footprints ahead of him – volcanic ash. He dug there and found ice 35cm below the surface. Thinking it was just a fluke, he tried digging another pit a short distance away, but hit ice again. A sheet of glacier ice was hiding under the rock and volcanic ash. The glacier had to be older than the dusting of ash above it, Marchant reasoned. He believes it is probably left over from an advance of the Taylor Glacier from 8 million to 15 million years ago.

"Like a little puddle that's frozen over with ice and covered with debris, it just stays there," Marchant said. "If it were flowing, it would be long since gone. But it just sits there and slowly sublimates."

Other researchers are dubious. Bernhard Hallet and Ron Sletten from the University of Washington started researching in Beacon Valley in 1996. The only ash deposits they found showed signs of having been moved about and mixed with other materials. They view the ash deposits as circumstantial evidence and believe they are likely redeposited, meaning the ice below could be much younger than Marchant's estimate. To better define the age of the ice, Hallet and Sletten are using cosmogenic isotopes, both within the ice and in the overlying soil, and studying the process of soil movement.



"We're skeptics for sure, but it's largely driven by the fact that we're interested in process and we see that the processes are quite active," Hallet said. "We're well aware that if a simple story fits your predisposition you won't go any further, whereas from where we look at it, it all looks pretty complicated."

Dating old ice

Establishing a date for ice can be difficult. So Marchant and colleagues at several universities have dated ash and rocks from above the ice as well as rocks embedded in the ice. The rock ages are derived by measuring the accumulation of isotopes called cosmogenic nuclides within the rocks. Cosmogenic nuclides are produced when cosmic rays collide with the nucleus of an atom. Since these nuclides are produced at known rates, their concentration in the rocks can be used to calculate how long the rock has been at or very near the Earth's surface.

In Beacon Valley, the measures of cosmogenic nuclides can also indicate how long rocks have been entombed within the buried ice and at what depth. They can be used to calculate how quickly the ice surface is lowering because of evaporation. This year Marchant and his collaborators at other universities dated six more volcanic ash samples and obtained 20 more cosmogenic nuclide dates for rocks. Based on that he determined that one section of ice he sampled this year was likely at least 7.6 million years old.

"It's interesting to think that you could be walking on the ground's surface and be stepping on rocks that haven't turned over, rotated, or adjusted for millions of years," Marchant said. "Outside Antarctica, the world was changing both biologically and then certainly with the advent of humans it was changing faster and faster, but this was just paralyzed. It's the same. It's a window back in time, unlike any other."

Marchant has previously published papers making his case for the age of the buried ice in a number of geological and other science journals, including Science, Geological Society of America Bulletin, and Earth and Planetary Science Letters.

Marchant has explanations for why the ice would remain for so long without evaporating. To start with, the glaciers accumulated ice very slowly, at a rate of about 2mm per year. Small rock falls were incorporated into the glacier as it slowly built up, creating dirty ice. At the head of the glacier, where it

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Photo by Peter West / Special to *The Antarctic Sun*

Photo by Dave Marchant / Special to *The Antarctic Sun*

Above, a light snow outlines the flow pattern in the dirt of Beacon Valley. Buried below the dirt is an ancient glacier, which Dave Marchant, at left, discovered. He believes the buried ice could be 7 million years old, based on the age of a volcanic ash layer he's found above it and rocks embedded in the ice. Other researchers have opposing theories.

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forms, the ice is exposed to the elements and does sublimate, or evaporate. In the process, the lowering ice exposes the rocks and dirt trapped in it. When that layer of debris on top reaches 15cm thick, it slows the ice evaporation. At 50cm thick, it effectively insulates the ice below and the sublimation may slow to levels approaching 5m per million years.

"It's a nice feedback mechanism, where you need debris in the ice to preserve it at all, and you have to have sublimation to bring that debris to the surface," Marchant said. "Once that's done efficiently, then you just preserve the ice."

Sletten and Hallet have also used cosmogenic nuclides to date rocks embedded in the ice, but they came to a different answer than Marchant. They found that the ice sublimates about 50m per million years, ten times faster than Marchant's number. At the faster rate, if the ice had been there 8 million years it would have lost 400m.

Working with Massachusetts Institute of Technology glaciologist Felix Ng, Hallett and Sletten also reanalyzed the age of the "sublimation till" — the residue that is left over when the dirty ice sublimates — and found that the till is only a few hundred thousand years old. They said this cast doubt that the underlying ice is as old as Marchant claimed

Powerful polygons

Both Marchant and Hallet base their models partially on the polygon shapes that form in the ground as cracks run through the rocky surface. These cracks relieve the stress as the ground expands and contracts with temperature. Hallet's research on similar looking polygons in the arctic shows that some polygons there can form within a year. Those northern polygons are dynamic. Dirt gathers in the cracks, causing more compression and movement of material through the ground.

They studied the expansion of cracks between the polygons, which seemed to be expanding and filling with sand at a rate of 1mm a year. At that rate, within several tens of thousands of years, all the soil in the valley would have turned over or been resurfaced, according to Sletten and Hallet.

"We'd be really surprised if you could keep any part of the surface intact for 1 million years. That's where we have a difference of opinion," said Hallet. "My feeling is that really it turns out to be really difficult to actually date any part of the surface and when we look at processes, they seem to be alive and well and very active now."

However, even ice persisting for several hundred thousand years is remarkable. Sletten is currently developing more accurate process models of sublimation.

Marchant notes that studies of surface processes in the Dry Valleys can be extremely complicated, in part because of variations in when and where meltwater runs. The Dry Valleys have several distinct climate zones, with varying geomorphic processes and resulting landforms. The Beacon Valley is in an upland frozen zone that lacks significant meltwater. This situation is very different from the coastal-thaw zone, where meltwater flows across the land on warm summer days. Hallet's model of polygon formation, which draws largely from his work in regions of the Arctic, may be applicable to some of the polygons within the coastal thaw zone. But Marchant said it doesn't appear to explain the origin and evolution of polygons in Beacon Valley, particularly those that lie over buried ice.

Marchant and his colleagues believe that some polygons above buried ice in the Beacon Valley are more stable than Hallet suggests, with many probably lasting up to 1 million years or longer. Because the valley is at the edge of the Antarctic Plateau, there is very little sand to blow into the cracks. Instead, larger bits of rock or dirt mix with ice to cover the crack, keeping it from filling. Without sand filling in the crack, the polygons are free to expand and contract as they need to without changing their basic structure.

"Everything we've studied in the upland frozen zone for the last 17 years has been consistent with ice preservation and inconsistent with rapid recycling of the landscape, as Sletten argues," Marchant said, defending the stability theory. "We've mapped and dated dozens of ash fall deposits and if the polygons were as dynamic as Ron Sletten and Bernard Hallet argue, we would not be able to find a single, intact volcanic ash older than 1 million years in the near-surface soil and yet we find dozens of them."

Sletten argues that few ashes have the old ages and many of the deposits may be reworked.

The edges of the polygons do occasion-

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ally slump off into the cracks, giving the polygon a rounded shape that makes them look like haystacks. This year Marchant and his colleagues were able to identify new areas likely to hold buried ice by flying over and looking for the "haystack polygons." The buried ice was found in those areas, and not in areas they predicted it wouldn't be, giving Marchant and Head confidence that they have identified tell-tale signs of the process.

Just like Mars

This is important, because Head has seen the same patterns in photos from Mars, called "basketball terrain" for its bumpy appearance. On Mars, portions of the terrain in the mid to high latitudes appear similar to Beacon Valley, with polygons and pitted rocks.

Recent spacecraft measurements detected subsurface ice. The Beacon Valley gives Head a chance to step into the Martian landscape and explore it.

"Getting out to the Dry Valleys was like being on Mars for six weeks," said Head, who has studied detailed pictures of the Mars surface from Viking in 1976 until the present. "These suggest that there may still be some residual ice. If we can crack the code of why there might be this ancient ice and what apparently shuts off or slows the sublimation rate to preserve the ancient ice, it will be really applicable to Mars, because the stuff on Mars is actually tens of hundreds of millions of years old, so it may be that the climate record of Mars for hundreds of millions of years is still there."

Part of the record could be trapped in gas bubbles within the ice, preserving the atmosphere from a given period in time. In hopes of finding that kind of record on Earth, Marchant took 17 ice cores from the buried Mullins Glacier this season. Atmospheric scientists will look at it for trapped gasses.

Photo courtesy of USGS / Special to *The Antarctic Sun*

The flow patterns of a buried glacier in Mullins Valley show up clearly in this satellite photo.

After seeing the three microclimate zones in the Dry Valleys, Head took a closer look at some features on Mars. He realized they were signs of past ice ages on the red planet, as he explained in the journal Nature in 2003. He believes Mars had ice and snow covering it from the poles down to about 30 degrees north and south latitude in the past 10 million years, as a result of periodic variations in its orbit and orientation toward the sun.

Small similarities

While the buried glaciers and "haystack polygons" may teach researchers about Mars on the large scale, Beacon Valley also has small scale similarities. The very rocks littering the valley floor look almost identical to ones seen on Mars. Both are pitted with holes of varying sizes.

After examining the rocks in Beacon Valley this season, Head thinks he understands what is creating the pits on the rocks both there and on Mars. A small amount of snow fell and collected only on the flat surfaces of the rock. Each snowflake contained some salt. The sun warmed the dark rock, melting the snow into a tiny puddle of water. When the water evaporated, it left a white ring of the salt on the sides of the pit. The salt remnants began etching the rock and eventually the etching would erode into a pit.

"I'm convinced based on the weathering rates and the nature of the process that many of the process are the same on Mars," Head said.

Like Beacon Valley, Mars is a frozen desert with extremely slow erosion rates.

This season he's bringing home 680kg of rock to examine and compare with Mars rocks. One of his graduate students, Rebecca Parsons, is focusing on the nature of the pits. She'll be dating the rocks and conducting experiments on them.

Parsons was one of six students who Head and Marchant brought into the field with them for six weeks this season, trying to understand one of the buried glaciers in Beacon Valley from many perspectives. The team will return in two years to follow-up and seek more answers.

"They will be contributions to Antarctic geoscience, but they're very very applicable to Mars as well," Head said.

Head and Marchant are helping planners of a possible Mars mission determine what to collect and what experiments to do, based on what they are learning in Beacon Valley.

"It's all process driven and if we understand the process here we can begin to understand the process on Mars," Marchant said.

NSF-funded research in this story: David Marchant, Boston University; Bernard Hallet, University of Washington, www.depts.washington.edu/qrc/research/research.html

Continental Drift — Why did you come to Antarctica?

"I want to live on every continent for six months or more. I'll be at McMurdo for winter."

Dani DiPietro,
South Pole FEMC
from Philadelphia, Pa.,
second season

"Free shoes and free sunglasses."

Joel Perkins,
McMurdo DA
from Mount Desert Island, Maine,
first season

"I always wondered what it was like *up* there."

Shayne Clausson,
Palmer Station
network engineer
from 8 Mile, Mich.
third season

Profile Capturing Ice, humor on camera

By Kristan Hutchison
Sun staff

Photo by Kristan Hutchison / *The Antarctic Sun*

Multimedia producer Eric Sturm films in the cockpit of an LC-130 earlier this season for a video press release on the anniversary of Robert Byrd's historic first flight to the South Pole.

Eric Sturm is such a funny guy, people don't realize he is seriously good at what he does.

It's like realizing that the class clown has been creating video games rather than playing them.

Or in Sturm's case, making videos. When he pulls out the cameras, Sturm turns quiet, focusing his keen eye and steady hand on the penguins, seals or scientists he's filming. Behind the unmarked door to the McMurdo TV station, he edits raw footage into Antarctic program training videos and video press releases.

"I definitely have one of the best jobs down here, as far as being able to see the continent," said Sturm, who is completing his sixth summer as the U.S. Antarctic Program multimedia producer at McMurdo Station. "I've seen B-15, been to the Pole, got to go in with the scientist right next to the penguins."

His own projects are branded with Sturm's irreverent sense of humor, like a mock television ad he created for the McMurdo film festival or the half-hour piece he was hired to film as a DVD insert for the soon to be released movie "Surfer King." The DVD insert is a spoof, something like what would have happened if Spinal Tap went on tour with a real band, Sturm said.

"He knows what he's doing. He has the ability to visualize humor and reproduce it far better than most people I know," said Joe Harrigan, a friend of Sturm's from McMurdo and executive producer on the project.

"Just being a friend of Eric, that's an adventure in itself," said Erik Sudheimer, who has known Sturm since they were assigned adjacent lockers in high school 12 years ago. "He's a very adventurous person, and the fact that he doesn't plan very well makes his life even more adventurous."

Sudheimer recalls a last-minute camping trip in Stillwater, Minnesota, where they grew up. They had only a tarp and a mosquito candle. Though it was pouring rain, Sudheimer remembers not being able to fall asleep because they were laughing so much.

"Eric definitely is a person that lives by the credo that whatever doesn't kill you makes you stronger," Sudheimer said.

Sturm has tested that credo repeatedly. After a first try at college, he worked two summers at a cannery in Larson Bay, Alaska. That was enough to drive him back to school.

> "Just being a friend of Eric, that's an adventure in itself."
>
> *– Erik Sudheimer, McMurdo resident and friend of Sturm's since high school*

He was studying media communications with an emphasis on media production at Webster University in St. Louis when a friend suggested they apply for jobs in Antarctica. Sturm expected to be a general assistant, but found the Antarctic program needed a videographer. He had already had an internship at PBS in St. Louis and worked as technical director on local cable news shows.

"I had the television experience and would work cheap enough. They actually hired me to do what I do," said Sturm.

His first year, Sturm went to the South Pole with ABC/PBS to help broadcast the millennium celebration. At one point, he was monitoring a camera on the roof of a building for several hours and started to sing to himself "Nobody knows the trouble I've seen," only to be asked by Peter Jennings to stay quiet, everyone could hear him in the New York studio. Later that night, while ABC/PBS was filming live coverage, they handed Sturm the camera that was broadcasting to millions of people worldwide.

The next year, iceberg B-15 was the big news story, and Sturm was sent to film it. Secured by a gunner's belt, Sturm leaned out the open door of a Coast Guard helicopter and filmed until his eyes were so cold he was seeing rainbows.

That's only one in his litany of classic Antarctic ailments. Because he can't wear gloves while working the camera, his fingers frequently swell up and turn white. The worst was the time he arrived on the season's first flight to the South Pole and had to jump off and begin filming immediately, in -60C temperatures. His fingers began to freeze, so he jumped up and down to warm them. That triggered the symptoms of altitude sickness, including stripping off layers of clothing. By the time Sturm was taken to the clinic, five minutes after getting off the plane, he had a mild case of hypothermia as well.

For all his adventures and Antarctic experiences, Sturm said what draws him back are the close friendships.

"The most interesting thing down here are the people, and it's the one thing I've never been able to turn the camera on," said Sturm, whose job is to document nature and science, not daily life. "All these adventurous people from all over the world, mountain climbers and travelers, all here in the one place that has the most rules."

Sturm plans to make this winter his final Antarctic season. For the first time, he is sharing the experience with Tanya Sturm, whom he married in March 2004 after a two-year courtship that crossed continents and oceans.

"I love to laugh with him and I feel very good when I can make him laugh, because he's the funny one, he's the good time," said Tanya Sturm, who worked in housing over the summer and will switch to the recreation department for the winter.

They'll save up money over the winter and have time together without having to worry about paying bills, cooking or doing dishes.

He looks forward to seeing the moon in Antarctica for the first time and having one last fling with Antarctica's wonder.

"There's times when you actually get away from McMurdo and the only sounds you can hear are the wind. I guess the word is breathtaking," Sturm said. "You forget that after six years. It just becomes flat and white."